

U.S. Patent Application Serial No. 09/854,474

Replace the paragraph beginning at page 1, line 16, with the following rewritten paragraph:

C²
A curable resin (also known as an addition type curable composition) in which a hydrocarbon polymer containing at least one alkenyl group within its molecule is crosslinked with a curing agent having two or more silicon-bound hydrogen atoms per molecule has been disclosed in Japanese Kokai Publication Hei-2-75644 and Japanese Kokai Publication Hei-3-181565, for instance. The cured product derived from such a composition (which artifact is also known as an addition type cured product) has excellent weather resistance, high heat resistance and low moisture permeability and, therefore, is expected to find application in a broad spectrum of end uses.

Replace the paragraph beginning at page 1, line 27, with the following rewritten paragraph:

C³
Particularly when an addition type curable composition comprising a hydrocarbon polymer is used as a coating or dipping agent or a sealant for various substrates, it must have a high adhesiveness for the various substrates. The known technology of imparting adhesiveness to such an addition type curable composition comprising a hydrocarbon polymer involves addition of various adhesion-improving agents to an addition type curable composition. By way of illustration, Japanese Kokai Publication Hei-4-185687 discloses a technique comprising adding a silane coupling agent to an addition type curable composition; Japanese Kokai Publication Hei-08-134165 discloses a technique comprising adding a nitrogen-containing epoxy compound and a silane coupling agent; Japanese Kokai Publication Hei-08-134165 discloses a technique comprising adding an isocyanate-containing compound and a silane coupling agent; Japanese Kokai Publication Hei-09-316293 and Japanese Kokai Publication Hei-10-204222 disclose a technology comprising adding a silane coupling agent, an alkoxysilane condensate and an organoaluminum and/or organotitanium

C³ compound. These techniques have the disadvantage, inter alia, that, depending on the kind of silane coupling agent, a retardation of cure may take place.

Replace the paragraph beginning at page 2, line 16, with the following rewritten paragraph:

C⁴ The object of the invention is to provide a primer composition which is effective in achieving a firm bond between a various substrate and a cured product derived from a hydrosilylation-curable composition comprising a hydrocarbon polymer containing at least one alkenyl group per molecule and a curing agent having two or more hydrogen atoms bound to silicon per molecule and to provide a bonding method.

Replace the paragraph beginning at page 2, line 23, with the following rewritten paragraph:

C⁵ Landing on a concept representing a complete departure from the prior art, the inventors of the present invention discovered that an addition type curable composition comprising a hydrocarbon polymer containing at least one alkenyl group per molecule and a curing agent having two or more hydrogen atoms bound to silicon per molecule and a cured product derived therefrom can be bonded to various substrates by utilizing a primer composition.

Replace the paragraph beginning at page 2, line 31, with the following rewritten paragraph:

C⁶ The present invention, therefore, is concerned with a primer composition comprising the following (A), (B), (C) and (D) components:

- (A) a hydrocarbon polymer containing at least one alkenyl group per molecule
- (B) a silane coupling agent

- C6
- (C) a polyvalent alkoxysilane and/or a condensation product thereof, and
 - (D) an organoaluminum compound and/or an organotitanium compound.
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Replace the paragraph beginning at page 3, line 31, with the following rewritten paragraph:

C7

A further preferred composition comprises a hydrocarbon polymer containing at least one alkenyl group per molecule, that is said (A) component, in addition to said (B) to (E) components.

Replace the paragraph beginning at page 4, line 4, with the following rewritten paragraph:

C8

More preferably, in this invention, the (A) component hydrocarbon polymer is a polyisobutylene polymer having a number average molecular weight in the range of 500 to 50000 and containing at least one alkenyl group terminally of its backbone and/or side chain.

Replace the paragraph beginning at page 4, line 17, with the following rewritten paragraph:

C9

The present invention is further directed to a bonding method for bonding a cured product to a substrate

which comprises coating a primer composition comprising a silane coupling agent as said (B) component on a substrate

and then applying a curable composition comprising a hydrocarbon polymer having at least one alkenyl group per molecule onto the primed substrate.

Replace the paragraph beginning at page 4, line 31, with the following rewritten paragraph:

The invention is further concerned with a bonding method for bonding a cured product to a substrate

C10 which comprises coating a primer composition comprising a polyvalent alkoxysilane and/or a condensation product thereof as (C) component and an organoaluminum compound and/or an organotitanium compound as (D) component on a substrate

and then applying a curable composition comprising a hydrocarbon polymer having at least one alkenyl group per molecule to the primed substrate.

Replace the paragraph beginning at page 5, line 5, with the following rewritten paragraph:

C11 Preferably, in this invention, said hydrocarbon polymer having at least one alkenyl group per molecule is a polyisobutylene polymer containing at least one alkenyl group terminally of its backbone and/or side chain and having a number average molecular weight in the range of 500 to 50000.

Replace the paragraph beginning at page 5, line 23, with the following rewritten paragraph:

C12 The (A) component for use in the invention is a hydrocarbon polymer having at least one hydrosilylatable alkenyl group within its molecule. The hydrosilylatable alkenyl group is not particularly restricted as far as it is a group containing a carbon-carbon double bond active for hydrosilylation. As such alkenyl groups, there may be mentioned aliphatic unsaturated hydrocarbon groups such as vinyl, allyl, methylvinyl, propenyl, butenyl, pentenyl, hexenyl, etc. and cyclic unsaturated hydrocarbon groups such as cyclopropenyl, cyclobutenyl, cyclopentenyl, cyclohexenyl

C12 and so on. In the present invention, the (A) component preferably has 1 to 10 alkenyl groups per molecule.

Replace the paragraph beginning at page 5, line 35, with the following rewritten paragraph:

The polymer constituting the backbone of the (A) component hydrocarbon polymer can be prepared by, for example,

(1) polymerizing an olefinic compound containing 1 to 6 carbon atoms, such as ethylene, propylene, 1-butene, isobutylene and the like, as a main monomer or

C13 (2) homopolymerizing a diene compound, such as butadiene, isoprene and the like, or copolymerizing said olefinic compound with said diene compound, followed by hydrogenation. In terms of the ease with which a functional group may be introduced terminally of the polymer, the molecular weight of the polymer be well controlled, and the number of terminal functional groups be increased, an isobutylene polymer, a hydrogenated polybutadiene polymer or a hydrogenated polyisoprene polymer is preferred.

Replace the paragraph beginning at page 7, line 3, with the following rewritten paragraph:

C14 The hydrogenated polybutadiene polymer or other hydrocarbon polymer may also contain unit monomers other than the main monomer just as said isobutylene polymer.

Replace the paragraph beginning at page 7, line 6, with the following rewritten paragraph:

C15 The hydrocarbon polymer for use as (A) component in the invention may be prepared using a monomer component leaving a double bond after polymerization, such as a polyene

C15 compound, e.g. butadiene, isoprene or the like, in a proportion not jeopardizing the object of the invention, i.e. in a small proportion, preferably within the range of not more than 10%.

Replace the paragraph beginning at page 7, line 13, with the following rewritten paragraph:

C16 The hydrocarbon polymer, preferably an isobutylene polymer, a hydrogenated polyisoprene polymer or a hydrogenated polybutadiene polymer, preferably has a number average molecular weight (GPC method; polystyrene equivalent) of not more than 100000, more preferably about 500 to 100000. In consideration of the ease of handling, a liquid polymer having sufficient fluidity with a molecular weight of about 1000 to 40000 is particularly preferred.

Replace the paragraph beginning at page 12, line 11, with the following rewritten paragraph:

C17 The vinyl monomer mentioned just above is not particularly restricted but includes, among others, esters of unsaturated carboxylic acids, such as methyl (meth)acrylate, ethyl (meth)acrylate, n-butyl (meth)acrylate, isobutyl (meth)acrylate, t-butyl (meth)acrylate, 2-ethylhexyl (meth)acrylate, lauryl (meth)acrylate, stearyl (meth)acrylate, benzyl (meth)acrylate, cyclohexyl (meth)acrylate, trifluoroethyl (meth)acrylate, pentafluoropropyl (meth)acrylate, diesters or hemiesters of polycarboxylic acids (maleic acid, fumaric acid, itaconic acid, etc.) with a straight-chain or branched-chain alcohols containing 1 to 20 carbon atoms, etc.; aromatic hydrocarbon type vinyl compounds such as styrene, α -methylstyrene, chlorostyrene, styrenesulfonic acid, 4-hydroxystyrene, vinyltoluene, etc.; vinyl esters and allyl compounds, such as vinyl acetate, vinyl propionate, diallyl phthalate, etc.; nitrile-containing vinyl compounds such as (meth)acrylonitrile; epoxy-containing vinyl compounds such as glycidyl (meth)acrylate; amino-containing vinyl compounds such as dimethylaminoethyl

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C17 (meth)acrylate, diethylaminoethyl (meth)acrylate, vinylpyridine, aminoethyl vinyl ether, etc.; amido-containing vinyl compounds such as (meth)acrylamide, itaconic acid diamide, α -ethylacrylamide, methacrylamide, crotonamide, maleic acid diamide, fumaric acid diamide, N-vinylpyrrolidone, N-butoxymethyl(meth)acrylamide, N,N-dimethylacrylamide, N-methylacrylamide, acryloylmorpholine, etc.; hydroxy-containing vinyl compounds such as 2-hydroxyethyl (meth)acrylate, 2-hydroxypropyl (meth)acrylate, 2-hydroxyethyl vinyl ether, N-methylol(meth)acrylamide, Aronix 5700 (product of Toa Gosei Chemical Industry Co.), Placel FA-1, Placel FA-4, Placel FM-1, Placel FM-4 (products of Daicel Chemical Co.), etc.; unsaturated carboxylic acids and acid anhydrides, inclusive of their salts, such as (meth)acrylic acid, maleic acid, fumaric acid, itaconic acid, etc., salts thereof (alkali metal salts, ammonium salts, amine salts, etc.), maleic anhydride, etc.; and other vinyl compounds such as vinyl methyl ether, vinyl chloride, vinylidene chloride, chloroprene, propylene, butadiene, isoprene, maleimide, N-vinylimidazole, vinylsulfonic acids and so on. Among these, alkyl (meth)acrylates containing 10 or more carbon atoms, such as lauryl (meth)acrylate and stearyl (meth)acrylate, are still more preferred because they provide for coats having a good affinity even for a low-polarity curable composition containing a hydrocarbon polymer.

Replace the paragraph beginning at page 17, line 3, with the following rewritten paragraph:

C18 The curable composition which can be advantageously used in combination with the primer composition of the present invention comprises a hydrocarbon polymer having at least one alkenyl group per molecule. It preferably comprises a curing agent as well.

Replace the paragraph beginning at page 17, line 8, with the following rewritten paragraph:

C19 The above-mentioned hydrocarbon polymer having at least one alkenyl group per molecule may be one similar to the (A) component of the primer composition of the invention.

The paragraph beginning at page 18, line 2, has been amended as follows:

C20 Among the various hydrosilyl-containing groups mentioned above, the following group is particularly preferred in view of the low likelihood of reducing the compatibility of the hydrosilyl-containing curing agent of the invention with the hydrocarbon polymer.

Replace the paragraph beginning at page 19, line 12, with the following rewritten paragraph:

C21 In the curable composition to be used in accordance with the invention, the molar ratio of the alkenyl group in the hydrocarbon polymer to the hydrosilyl group in the curing agent is generally 1:0.5 to 1:5, preferably 1:0.8 to 1:3, still more preferably 1:1 to 1:2.5.

Replace the paragraph beginning at page 20, line 3, with the following rewritten paragraph:

The bonding method of the invention includes the following mode, among others.

- C22
- (1) The primer composition is first coated on the surface of a substrate and the primer is cured within a temperature range of room temperature to 150 °C for 1 minute to 60 minutes.
 - (2) Then, on the primed surface, an addition type curable composition comprising a hydrocarbon polymer is coated and cured in situ under the curing conditions specific to the particular addition type curable composition of this hydrocarbon polymer.